NEW YORK STATE DEPARTMENT OF PUBLIC WORKS

PRELIMINARY GEOLOGIC REPORT
PROPOSED RELOCATION OF ROUTE U.S. 104
ACROSS IRONDEQUOIT BAY
MONROE COUNTY

BUREAU OF SOIL MECHANICS
APRIL 1959

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TECHNICAL REPORT

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DIRECTOR

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

J. BURCH McMORRAN
SUPERINTENDENT

ALBANY 1, N.Y.

April 24, 1959

Subject: Transmittal of "Preliminary Geologic Report Proposed Relocation of Route U.S.104 Across Irondequoit Bay Monroe County"

Mr. B. F. Perry
District Engineer
Barge Canal Terminal
Rochester 1, New York

Dear Sir:

In accordance with your request, this Bureau has completed a preliminary geologic survey of the area at the location of the above proposed project.

The results of this Bureau's work at this location are described in the attached report entitled, "Preliminary Geologic Report, Proposed Relocation of Route U. S. 104 Across Irondequoit Bay, Monroe County."

Very truly yours,

Wm. P. Hofmann
Principal Soils Engineer

WPH:GBM
Distribution:

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PRELIMINARY GEOLOGIC REPORT
PROPOSED RELOCATION OF ROUTE U. S. 104
ACROSS IRONDEQUOIT BAY
MONROE COUNTY

I. AUTHORIZATION

In accordance with the request from Bernard F. Perry, District Engineer, dated April 3, 1958, the Bureau of Soil Mechanics has completed a preliminary geologic survey of the Irondequoit Bay crossing for the proposed relocation of Route U. S. 104. The results of this geologic survey, as contained in this report, are based on seismic surveys along two lines across the bay and a study of the geologic conditions and history of the general area. The seismic surveys and the geologic studies were performed under the direct supervision of Paul H. Bird, Senior Engineering Geologist of the Bureau of Soil Mechanics.

II. PURPOSE

The purpose of the investigation discussed herein was to indicate the general geology of this immediate area and, consequently, to indicate the general foundation problems and conditions involved in the design and construction of the bay crossing. The information derived from this investigation will also serve as a general guide in planning and progressing more detailed subsurface explorations and investigations to govern the design and construction of the foundations of the proposed bay crossing structure.

III. PROCEDURE

Immediately after receiving Mr. Perry's request, this Bureau initiated proceedings to obtain funds to purchase the special

seismic equipment necessary to progress underwater seismic surveys. The funds were subsequently authorized, and heavy bay cable, underwater pick-ups, fathometer, floats, etc. were purchased in time for the seismic field operations to be started during the latter part of October. Prior to the commencement of seismic field operations, it was necessary to obtain permission to perform such operations from the U. S. Department of Defense and the New York State Conservation Department. The field operations were completed in the early part of November 1958. Concurrent with the field operations, each seismic determination point was located by means of triangulation by a survey party furnished by the District.

The triangulation points occupied were established by means of a highly precise triangulation net extended into the area by District forces from U. S. Coast and Geodetic triangulation points located a considerable distance to the east.

A location map of the various seismic determination points was received by this Bureau from the District on December 28, 1958.

Generally, seismic determinations were made along two lines, extending across the bay, such that two geologic cross-sections could be produced. One line extended from triangulation point "M", easterly across the bay to triangulation point "A", at an azimuth of 64° 50′ 13". This line constitutes the "north line." The second line extended through triangulation point "Q", easterly across the bay on an azimuth of 72° 53′ 50". This letter line constitutes the "south line."

IV. RESULTS

The general location of the two lines is shown on Figure 1 (Drawing No. 4SM 1558A). The geologic section for the north line

is shown on Figure 2 (Drawing No. 4SM 1558B). The geologic section for the south line is shown on Figure 3 (Drawing No. 4SM 1558C). The cross-section for the north line is based on the results of the seismic survey along this line, the profiles of three nearby drill holes progressed by the District Soils Section projected perpendicular to the line, and the profiles of three water wells in the Town of Webster projected perpendicular to the line. The cross-section for the south line is based on the results of the seismic survey along this line and a surface inspection of the deposits visible along the westerly shore of the bay.

The depths of the water and the profiles of the bottom of the bay, as shown on the geologic sections for the two lines, were determined by a fathometer and are believed to be reasonably correct.

The geologic sections for the north and south lines across the bay indicate that the bay overlies a deep trough in the surface of the bedrock at this location. At its deepest point, the surface of the bedrock is approximately 350 feet below the surface of the bay at both the north and south lines. Since the water in the bay is approximately 60 feet deep at these immediate locations, it is apparent that approximately 290 feet of unconsolidated sediments lie between the bottom of the bay and the surface of the bedrock, constituting the bottom of the trough.

Neither the general characteristics nor the layer profile of the materials composing this deposit of unconsolidated sediments could be established using the seismic instruments possessed by the Bureau of Soil Mechanics at the time this work was done. All that is presently known about this deposit is that it has a seismic

velocity of approximately 5,000 feet per second. Based on past experience, the drill hole data and the water well data and the visually apparent geologic pattern of the area, it is quite probable that this deposit is composed of layers of silts and fine sands, possibly containing layers of clay and sand and gravel lenses. It is also quite probable that the surface of this deposit (i.e., the bottom of the bay) consists of a layer of soft muck, the thickness of which is unknown. This is evidenced by the fact that Drill Hole No. 2, located near the shore at the west end of the north line, encountered approximately 10 feet of muck. Also, the large cast iron pipe ell, used for an anchor on the seismic recording boat, frequently came up full of black muck. It is quite probable, therefore, that muck covers all or a portion of the bay bottom.

The seismic survey data for both lines show a somewhat indefinite indication of a ridge-like mass of glacial till immediately overlying bedrock in the deep part of the bay. This is indicated on the sections as indefinite and, therefore, with dash lines. The size and shape of this mass, as shown on the sections, should be considered as indefinite and, therefore, as suggestive only.

Recently, the Bureau purchased two new seismic instrument units of the latest high resolution type, which, if had been available for this work, would have produced a better indication of the nature and characteristics of the materials composing the deposit of unconsolidated material. However, the use of such equipment would not have substantially changed the accuracy of the elevation of the surface of the bedrock underlying the bay,

as shown on the sections, nor would the use of such equipment have eliminated the necessity of exploring in detail the unconsolidated sediment deposit by means of drill holes.

V. GEOLOGIC HISTORY OF THE AREA

The geologic history of this immediate area is quite complex, but the following outstanding events are useful in explaining the landforms and deposits that have a bearing on the present problem:

(A) Previous to the geologically recent glaciation of the area, it is believed that a master river occupied the basin of Lake Ontario, which at that time was simply a great river valley. The direction of the flow of that river and the extent to which the original valley must have been modified by glacial action is extremely hypothetical. The ancient Genesee River was tributary to this master river, but it then flowed through the valley now occupied by Irondequoit Bay. The result of some recent seismic determinations performed by the Bureau of Soil Mechanics indicates that the ancient Genesee River flowed in a bedrock valley, the bottom of which was some 350 feet below the present water surface of Irondequoit Bay. At that time, this part of North America probably stood at a much higher elevation with respect to sea level than at present.

(B) The advance of the glacier evicted the ancient Genesee from its valley and covered the entire area with a great thickness of slowly creeping ice.

(C) This ice sheet acted as an agent of erosion and transportation at some places and, as such, gathered up and pushed along beneath it great quantities of soil, weathered rock, etc. Eventually, in its advance, it became overloaded, then ceased to erode, and deposited the material it could no longer move. It is quite probable, therefore, that the area of Irondequoit Bay was a site of deposition as contrasted to a site of erosion somewhere to the north from which the materials were derived. The material deposited in this manner beneath the flowing ice is called "glacial till." This material consists of a dense, relatively impervious, unstratified, heterogeneous mixture of soil and rock materials ranging in grain size from sub-miscroscopic to boulders several feet or more in diameter. In this part of the State, great quantities of glacial till were deposited in the form of steep sided, elongated, streamlined hills as much as one hundred feet or more high and up to a mile or more long, with their axes parallel to the ice movement. Such hills are called "drumlins."

Glacial till was encountered beneath sand and silt in all three drill holes, as shown on the section for the north line. Glacial till occurs above bay level in an excavation at the west end of the Prospect House parking area. It also forms the west shore of the bay for a distance

of about a thousand feet south from the Prospect House, where it rises to a height of 80 feet above the bay level. From there it can be traced due south to the valley of Densmore Creek, where it outcrops at the surface over a considerable area. Throughout most of this area, the glacial till is overlain with silt and sand. The subsurface form of the glacial till is very probably that of a drumlin. It is probably due to the characteristical steep-sided form of a drumlin that the glacial till along the west shore of the bay drops off very steeply and extends only a short distance out under the water. It is also quite possible that the ridge-like indefinite mass shown on the sections overlying bedrock on the bottom of the trough is also a drumlin, or the remains of a drumlin.

(D) The glacier withdrew from the Great Lakes region in a series of recessional impulses. Then, as now, the climate fluctuated from cold to warm and back again. During the warmer periods, the ice front receded, and during the colder periods, the ice front became stationary or even advanced slightly. The steps in this process are recorded in the form of deposits, such as beaches, deltas, bars, etc. One of these stages led to the formation of deposits of considerable importance to the present problem. This particular stage consisted of a long delay in the recession of the

ice that blocked the St. Lawrence drainageway, thus raising the level of Lake Ontario until it overflowed into the Mohawk Valley through a channel in the vicinity of Rome. While this glacial lake, known as Lake Iroquois, stood at this high level, a very prominent beach was developed. This beach is today followed over much of its length by the "Ridge Road" - Route U. S. 104, the proposed relocation of which initiated the problem with which this report is concerned. During the existence of Lake Iroquois, the Genesee River deposited a tremendous amount of silt and sand out into the lake in the form of a delta. The comparatively level surface of this resulting delta now stands at an elevation of approximately 400 to 425 feet above sea level in the vicinity of Irondequoit Bay. The silts and sands exposed in the bluffs on both sides of the bay are a part of this delta deposit. The same type of material was penetrated by the drill holes on the west side of the bay and in drilling the Webster wells on the east side of the bay to the depths shown on the section for the north line. It, therefore, seems reasonable to assume that the material between the bottom of the bay and the surface of the bedrock, with the exception of the indefinite ridge of glacial till, consists wholly or in part of the deltaic silts and sands.

(E) In the vicinity of the Prospect House, the bedrock comprising the surface of the bottom of the rock trough is the upper part of the Queenston formation, which is predominantely soft red shale. This formation is normally overlain by the Medina formation, which consists mostly of hard sandstone. In the normal development of a rock valley by stream erosion, such a succession of strata; i.e., a hard resistant formation over a soft formation, generally leads to the creation of a waterfall. In fact, the lower falls of the present Genesee River are caused by these same two formations. At the time of the seismic survey, it was thought possible that the deepening of the bay from about 35 feet to 65 feet while proceeding north in the vicinity of the Prospect House was the reflection of an ancient waterfall at this location. Since that time, however, geologic data have been found to indicate that if such a waterfall did exist, it is very probably farther south, possibly even south of the head of the bay. The possibility of encountering bedrock at elevations appreciably higher than those shown on the sections by shifting the line of the proposed bridge a reasonable distance to the south is, therefore, considered remote.

VI. CONCLUSIONS

As a result of the geologic investigations progressed to date at this location, the following conclusions may be drawn:

(A) At this immediate location, the water in the bay has a maximum depth of approximately 60 feet.

(B) It is probable that the surface of the bottom of the bay consists of soft muck extending to an unknown depth.

(C) At this immediate location, Irondequoit Bay is underlain by a deep trough in the surface of the bedrock. The depth of the deepest part of the trough below the surface of the water is approximately 350 feet.

(D) The layer profile and characteristics of the materials composing the deposit extending from the bottom of the bay to the surface of the bedrock trough is presently unknown, but probably consists of a layer of muck and organic silt comprising the bottom of the bay underlain by silts and sands, possibly containing layers of clay and lenses of sand and gravel.

(E) The possibility of bedrock existing at considerably lesser depths below the surface of the bay within a reasonable distance of this immediate location is presently considered remote. However, due to the complexity of the geologic conditions in this area, such a possibility should not be overlooked, provided it is feasible and practical to move the proposed location of the bridge a considerable distance to the south.

VII. RECOMMENDATIONS

The information contained in this report represents a guide for future action on the foundation engineering aspects of this project. The immediate course of action to be followed depends upon the various factors governing the location of the proposed bridge across the bay and may follow two general paths. This Bureau wishes to present the following recommendations concerning the various courses of action, depending upon the factors and considerations involved:

(A) If it is considered feasible to move the proposed location of the bridge a very considerable distance to the south from the present general Inspiration Point location, the possibility of the existence of bedrock at depths considerably less than at that location should be investigated. If moving the proposed location a considerable distance south is feasible and practical, then this Bureau should be immediately requested to perform a seismic survey southerly along the axis of the bay from Inspiration Point in an effort to locate a point where bedrock exists at a relatively shallow depth below the surface of the bay. In considering this possible shift, it should be kept in mind, however, that the possibility of the existence of such a condition is remote.

(B) If the location of the proposed bridge is reasonably firmly established at the vicinity of Inspiration Point and in reasonably close proximity to either of

the lines for which geologic sections are included in this report, and if it is not considered feasible to move the present location an appreciable distance to the south, the next logical phase of the general design of this project is to progress a preliminary subsurface exploration program at the site of the proposed bridge to indicate the subsurface profiles, the characteristics of the materials involved, and the problems to be encountered in the design and construction of the foundations for this structure. If such is the case, it is hereby recommended that not less than four drill holes be progressed along the centerline of the proposed bridge to thoroughly investigate the nature and characteristics of the materials comprising the deposit of unconsolidated sediments composing the bottom of the bay and extending to the surface of the bedrock. These holes should be drilled with four-inch casing, making possible the extraction of undisturbed Shelby tube samples, if necessary, for laboratory testing. If this recommendation is concurred in, the details of the number, spacing, location and depth of holes can be established by cooperation among the District Engineer, the Deputy Chief Engineer of Bridges and the Bureau of Soil Mechanics. It should be noted that the results of these drill holes will constitute the preliminary phase of the subsurface exploration program for this project. It is quite probable

that additional holes will be necessary as the design progresses. Since the progression of these drill holes in the bay will require extensive water equipment, such as barges, rafts, anchors, etc., which the Soils Section of District 4 does not possess, it is recommended that subsurface exploration work in the waters of the bay be progressed by a contract prepared by the Bureau of Soil Mechanics and supervised by the District, as has been done in the case of several other major projects of this type.

Wm. P. Hofmann
Principal Soils Engineer
Bureau of Soil Mechanics

Date: April 20, 1959

FIG. 1

SCALE 2.65" – 1 MILE APPROX.
(1: 24000)

DRAWN BY: N.W. JENSEN

CHECKED BY: F. IRVING

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

SEISMIC SURVEY
PROPOSED IRONDEQUOIT BAY BRIDGE
RELOCATED ROUTE U. S. 104
LOCATION PLAN

APPROVED 4/20, 19 59
Wm. P. Hofmann
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 4
COUNTY MONROE
DWG NO 4 SM 1558A

LEGEND

- ○ TOP OF ROCK (SEISMIC DETERMINATION POINTS)
- □ ASSUMED TOP OF ROCK (VILLAGE OF WEBSTER WELLS PROJECTED TO BASELINE)

FIG. 2

SCALE

ONTAL 1" = 200'

ICAL 1" = 100'

ANALYSIS BY: F. IRVING

BY: N. W. JENSEN

D BY: F. IRVING

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
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BUREAU OF SOIL MECHANICS

SEISMIC SURVEY
PROPOSED IRONDEQUOIT BAY BRIDGE
RELOCATED ROUTE U.S. 104
SECTION THROUGH NORTH LINE
(MA - AZ. 64° 50' 13")

APPROVED APRIL 20, 1959

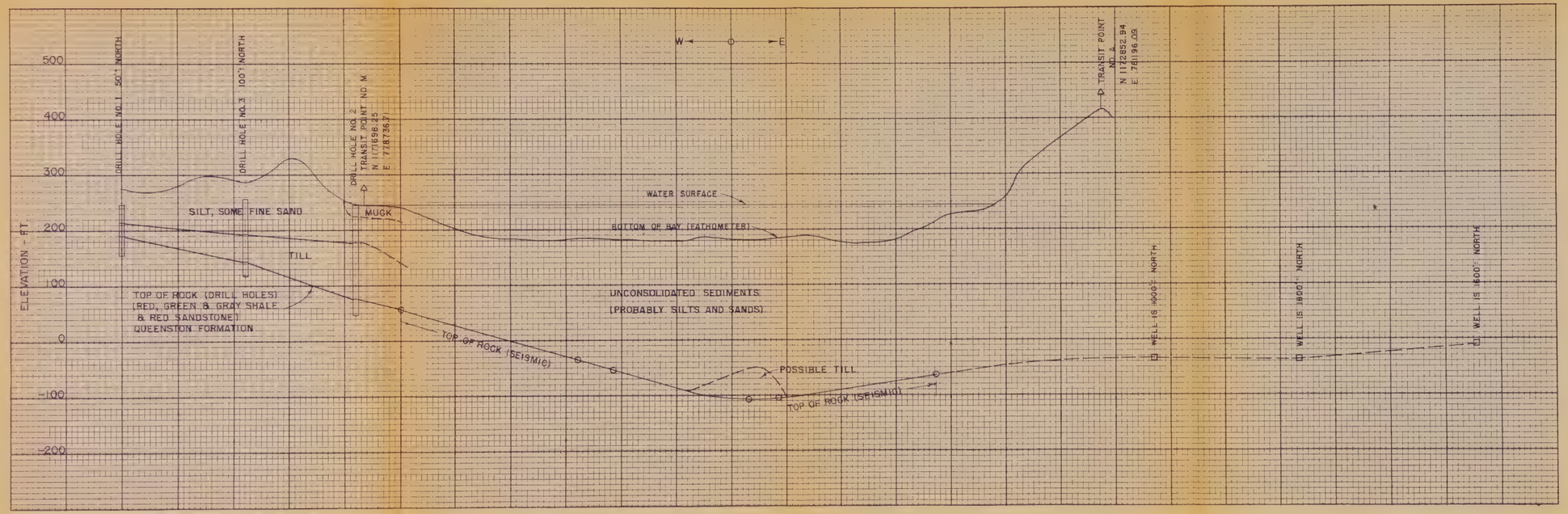
Wm. P. Holmann

PRINCIPAL SOILS ENGINEER

DISTRICT NO. 4

COUNTY MONROE

DRAWING NO. 4SM1558B



LEGEND

- ○ TOP OF ROCK (SEISMIC DETERMINATION POINTS)
- □ ASSUMED TOP OF ROCK (VILLAGE OF WEBSTER WELLS PROJECTED TO BASELINE)

SCALE

HORIZONTAL 1" = 200'

VERTICAL 1" = 100'

SEISMIC ANALYSIS BY: F. IRVING

DRAWN BY: N. W. JENSEN

CHECKED BY: F. IRVING

FIG. 2

STATE OF NEW YORK
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SEISMIC SURVEY
PROPOSED IRONDEQUOIT BAY BRIDGE
RELOCATED ROUTE U.S. 104
SECTION THROUGH NORTH LINE
(MA - AZ. 64° 50' 13")

APPROVED APRIL 20, 1959
Wm. F. Hofmann
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 4
COUNTY MONROE
DRAWING NO. 4SMI558 B

LEGEND

○ TOP OF ROCK (SEISMIC DETERMINATION POINTS)

FIG 3

CALE

AL 1" = 200'

1" = 100'

ALYSIS BY: F. IRVING

N. W. JENSEN

Y: F. IRVING

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

DIVISION OF CONSTRUCTION

BUREAU OF SOIL MECHANICS

SEISMIC SURVEY
PROPOSED IRONDEQUOIT BAY BRIDGE
RELOCATED ROUTE U.S. 104
SECTION THROUGH SOUTH LINE
(Q ⟶ AZ. 72° 53' 50")

APPROVED APRIL 20, 1959

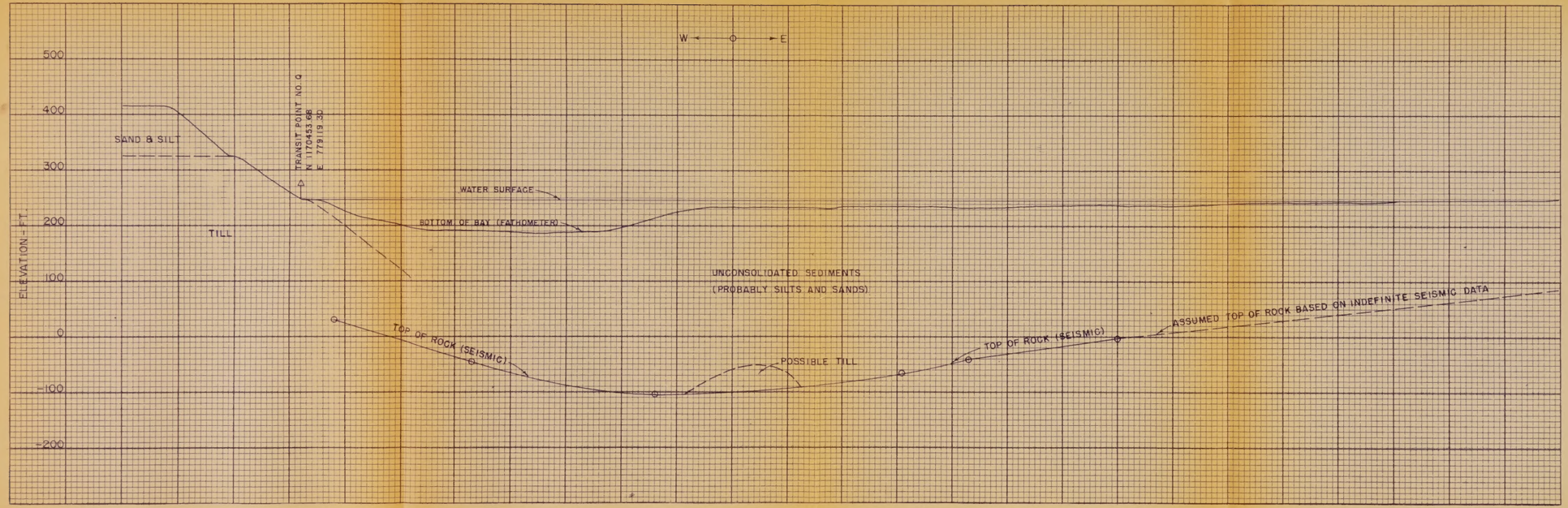
Wm. F. Holmann

PRINCIPAL SOILS ENGINEER

DISTRICT NO. 4

COUNTY MONROE

DRAWING NO. 4SM1558C



LEGEND

O TOP OF ROCK (SEISMIC DETERMINATION POINTS)

FIG 3

SCALE

HORIZONTAL 1" = 200'

VERTICAL 1" = 100'

SEISMIC ANALYSIS BY: F. IRVING

DRAWN BY: N. W. JENSEN

CHECKED BY: F. IRVING

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

SEISMIC SURVEY
PROPOSED IRONDEQUOIT BAY BRIDGE
RELOCATED ROUTE U.S. 104
SECTION THROUGH SOUTH LINE
(Q ——→ AZ. 72° 53' 50")

APPROVED APRIL 20, 1959

Wm. P. Hofmann
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 4
COUNTY MONROE
DRAWING NO. 4SM1558 C

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